

TABLE 1.—Free-air temperatures, humidities, and vapor pressures during May, 1924

Altitude. m. s. l. (m.)	TEMPERATURE (°C.)											
	Broken Arrow, Okla. (233 m.)		Drexel, Nebr. (396 m.)		Due West, S. C. (217 m.)		Ellendale, N. Dak. (444 m.)		Groesbeck, Tex. (141 m.)		Royal Center, Ind. (225 m.)	
	Mean	De- parture from 6-yr. mean	Mean	De- parture from 9-yr. mean	Mean	De- parture from 4-yr. mean	Mean	De- parture from 7-yr. mean	Mean	De- parture from 6-yr. mean	Mean	De- parture from 6-yr. mean
Surface	16.4	-3.0	13.1	-2.8	20.2	-0.2	9.5	-3.4	21.1	-1.6	14.4	-2.2
250	16.3	-3.0	13.1	-2.8	19.9	-0.2	9.5	-3.4	20.2	-1.6	14.2	-2.1
500	14.5	-2.9	12.4	-2.8	17.9	+0.1	9.1	-3.5	18.3	-1.7	11.8	-2.0
750	13.3	-2.6	10.8	-2.7	16.2	+0.2	7.1	-3.9	17.0	-1.6	9.4	-2.5
1,000	12.4	-2.3	9.2	-2.8	14.4	-0.1	5.4	-4.1	16.1	-1.2	7.5	-2.8
1,250	11.1	-2.4	7.9	-2.7	12.9	-0.1	4.0	-4.1	15.2	-1.0	5.6	-3.1
1,500	9.8	-2.5	6.6	-2.5	11.3	-0.2	2.5	-4.1	14.1	-1.0	3.7	-3.5
2,000	7.1	-2.6	4.2	-2.3	9.2	+0.2	-0.3	-4.0	11.8	-1.0	0.5	-4.1
2,500	5.3	-1.8	1.7	-2.1	5.9	-0.3	-3.4	-4.2	9.5	-0.7	-1.9	-4.0
3,000	2.5	-1.6	-0.6	-1.5	3.0	-0.4	-6.4	-4.4	7.3	-0.2	-4.8	-4.1
3,500	-0.4	-1.7	-3.1	-1.3	0.1	-0.5	-9.2	-4.6	4.4	-0.1	-8.2	-4.6
4,000	-3.9	-2.0	-6.1	-1.1	-3.3	-0.8	-12.3	-4.7	1.4	-0.1		
4,500	-7.1	-2.0	-8.1	-0.1	-6.9	-1.2	-16.0	-5.5				
5,000			-10.3	+0.9	-9.7	-0.6	-19.2	-0.3				

RELATIVE HUMIDITY (%)

Surface	68	-5	60	-5	61	-4	57	-5	71	-1	67	+4
250	68	-5	60	-5	61	-4	57	-5	72	0	67	+4
500	66	-6	59	-5	61	-4	57	-5	74	+1	66	+3
750	64	-8	58	-5	61	-4	57	-5	75	+3	68	+5
1,000	62	-7	58	-4	62	-4	58	-4	72	+2	70	+8
1,250	62	-7	58	-4	62	-4	58	-4	66	0	72	+10
1,500	61	-5	58	-4	63	-3	58	-4	63	+1	77	+15
2,000	61	-2	55	-4	58	-7	58	-3	60	+4	76	+17
2,500	54	-5	56	-1	51	-10	62	+1	57	+5	70	+16
3,000	54	-4	52	-5	42	-14	64	+1	53	+3	64	+14
3,500	50	-3	49	-7	37	-14	57	+3	49	+2	75	+26
4,000	52	-1	59	+3	33	-12	54	+1	49	+3		
4,500	56	-1	61	+3	32	-11	64	+9				
5,000			60	0	30	-11	67	+10				

TABLE 2.—Free-air resultant winds (m. p. s.) during May, 1924

RESULTANT WIND DIRECTION AND VELOCITY (m. p. s.)

Altitude. m. s. l. (m.)	Broken Arrow, Okla. (233 meters)				Drexel, Nebr. (396 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)			
	Mean		6-year mean		Mean		9-year mean		Mean		4-year mean		Mean		7-year mean		Mean		6-year mean		Mean		6-year mean	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface	N. 67° W.	1.0	S. 21° E.	1.6	N. 50° W.	2.6	S. 8° W.	1.1	S. 69° W.	3.9	S. 62° W.	0.3	N. 10° W.	5.4	N. 33° E.	0.6	S. 10° E.	2.2	S. 15° E.	2.0	S. 83° W.	3.5	N. 44° E.	0.4
250	N. 71° W.	0.8	S. 22° E.	1.6	N. 50° W.	2.6	S. 8° W.	1.1	S. 68° W.	4.2	S. 61° W.	0.5	N. 10° W.	5.4	N. 33° E.	0.6	S. 9° E.	2.0	S. 10° E.	2.5	S. 81° W.	3.6	N. 48° E.	0.4
500	S. 85° W.	2.0	S. 12° E.	2.3	N. 47° W.	3.7	S. 12° W.	1.1	S. 73° W.	6.0	S. 80° W.	0.7	N. 9° W.	5.6	N. 46° E.	0.4	S. 5° E.	3.5	S. 3° E.	3.0	S. 69° W.	6.2	S. 51° W.	0.1
750	N. 89° W.	1.4	S. 3° E.	2.7	N. 44° W.	5.6	S. 21° W.	1.2	S. 75° W.	7.1	S. 74° W.	1.2	N.	5.6	S. 60° E.	0.5	S. 5° W.	4.0	S. 7° W.	4.1	S. 68° W.	7.3	S. 74° W.	0.6
1,000	S. 88° W.	2.1	S. 14° W.	2.9	N. 48° W.	7.4	S. 43° W.	1.8	S. 79° W.	7.4	S. 84° W.	1.7	N. 5° W.	5.6	S. 18° E.	0.7	S. 18° W.	4.2	S. 20° W.	4.6	S. 73° W.	8.9	W.	1.2
1,250	N. 81° W.	2.9	S. 33° W.	3.0	N. 51° W.	8.4	S. 53° W.	2.3	S. 82° W.	8.4	S. 76° W.	2.8	N. 6° W.	5.7	S. 8° W.	1.0	S. 34° W.	4.1	S. 28° W.	4.9	S. 75° W.	8.7	N. 77° W.	1.6
1,500	N. 79° W.	3.9	S. 44° W.	3.3	N. 53° W.	9.5	S. 61° W.	3.0	S. 84° W.	10.1	S. 72° W.	4.0	N. 16° W.	6.2	S. 24° W.	1.4	S. 48° W.	3.9	S. 38° W.	4.8	S. 82° W.	8.6	N. 80° W.	2.2
2,000	N. 62° W.	6.2	S. 67° W.	4.0	N. 54° W.	11.1	S. 74° W.	4.2	S. 87° W.	11.8	S. 78° W.	5.3	N. 29° W.	7.0	S. 45° W.	2.3	S. 62° W.	3.6	S. 50° W.	4.8	S. 88° W.	9.6	N. 84° W.	3.2
2,500	N. 65° W.	9.6	S. 87° W.	5.3	N. 59° W.	11.6	S. 82° W.	4.9	N. 89° W.	12.8	S. 83° W.	6.7	N. 43° W.	7.9	S. 50° W.	3.8	S. 82° W.	4.8	S. 87° W.	5.4	N. 87° W.	11.7	N. 84° W.	4.2
3,000	N. 66° W.	11.4	N. 81° W.	6.3	N. 62° W.	13.2	S. 85° W.	7.1	S. 82° W.	13.5	W.	8.4	N. 48° W.	9.3	S. 60° W.	5.0	N. 75° W.	7.4	S. 81° W.	6.9	N. 85° W.	14.4	N. 81° W.	5.5
3,500	N. 72° W.	12.7	N. 74° W.	9.3	N. 62° W.	12.0	S. 89° W.	8.2	S. 82° W.	14.4	N. 83° W.	8.4	N. 55° W.	10.4	S. 72° W.	5.0	N. 05° W.	13.0	N. 88° W.	8.6	N. 84° W.	16.6	N. 69° W.	6.8
4,000	N. 83° W.	12.0	N. 67° W.	11.3	N. 85° W.	11.8	N. 84° W.	8.9	S. 85° W.	15.0	N. 75° W.	10.8	N. 51° W.	11.0	S. 83° W.	5.0	N. 56° W.	13.8	N. 66° W.	12.2				
4,500	N. 72° W.	17.9	N. 65° W.	17.9	N. 79° W.	13.5	S. 78° W.	10.5	W.	13.7	N. 69° W.	10.4	N. 45° W.	10.9	N. 76° W.	3.3	N. 45° W.	13.8	N. 59° W.	14.1				
5,000	N. 45° W.	26.0	N. 45° W.	26.0	N. 75° W.	14.6	N. 86° W.	10.0	W.	14.0	N. 80° W.	15.3	N. 67° W.	14.1	N. 45° E.	3.3								

THE WEATHER ELEMENTS

By P. C. DAY, Meteorologist, in Charge of Division

PRESSURE AND WINDS

The marked persistence of low atmospheric pressure, and the frequency of moderate cyclonic conditions over the districts from Mississippi Valley eastward, and the movement southward from Alberta along the eastern slopes of the Rocky Mountains and over the Great Plains of several anticyclones, favored the prevalence of northerly and westerly winds over much of the country from the Rocky Mountains eastward. As a result of

TABLE 1.—Free-air temperatures, humidities, and vapor pressures during May, 1924—Continued

Altitude. m. s. l. (m.)	VAPOR PRESSURE (mb.)											
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	Mean	De- parture from 6-yr. mean	Mean	De- parture from 9-yr. mean	Mean	De- parture from 4-yr. mean	Mean	De- parture from 7-yr. mean	Mean	De- parture from 6-yr. mean	Mean	De- parture from 6-yr. mean
Surface	13.02	-3.70	8.81	-3.15	14.88	-0.82	6.23	-3.19	17.87	-2.01	11.06	-0.92
250	12.88	-3.69	8.81	-3.15	14.64	-0.78	6.23	-3.19	17.24	-1.81	10.86	-0.90
500	11.12	-3.46	8.25	-3.06	13.03	-0.58	6.05	-3.12	15.85	-1.37	9.09	-0.92
750	10.09	-3.01	7.20	-2.77	11.72	-0.64	5.36	-2.70	14.96	-0.63	8.11	-0.72
1,000	9.44	-2.52	6.50	-2.50	10.47	-0.75	4.87	-2.42	13.37	-0.60	7.28	-0.63
1,250	8.45	-2.30	6.01	-2.15	9.44	-0.74	4.50	-2.20	11.35	-0.55	6.73	-0.58
1,500	7.59	-1.81	5.56	-1.80	8.44	-0.74	4.13	-1.96	9.70	-0.59	6.24	-0.58
2,000	6.28	-1.24	4.44	-1.38	6.26	-1.14	3.43	-1.43	7.84	-0.19	4.74	-1.14
2,500	4.82	-0.98	3.77	-0.92	4.36	-1.64	2.86	-0.95	6.63	+0.23	3.70	-0.09
3,000	3.86	-0.62	2.92	-0.89	2.79	-1.93	2.19	-0.80	5.51	+0.21	2.87	-0.30
3,500	3.12	-0.61	2.12	-0.92	1.81	-1.07	1.85	-0.67	4.55	+0.33	2.97	-0.93
4,000	2.62	-0.63	1.86	-0.57	1.14	-1.85	1.13	-0.58	3.90	+0.39		
4,500	2.28	-0.53	1.40	-0.61	0.64	-1.64	0.74	-0.48				
5,000			1.04	-0.63	0.31	-1.59	0.29	-0.53				

this inflow of air from higher latitudes or more elevated regions the weather continued cold over the districts between the Rocky Mountains and the Mississippi Valley, and almost constant cold, cloudy, rainy weather prevailed during the month over much of the country from the Mississippi Valley eastward.

The most important cyclone of the month in its general effect upon the weather first assumed prominence in the lower Missouri Valley on the morning of the 5th, and, with secondary disturbances that developed within the main low pressure area, or that combined with it in its slow eastward movement, dominated the weather over the districts from the Mississippi Valley eastward until after the end of the first decade. During this

period showers were of almost daily occurrence over large areas of the central and eastern districts, and heavy rains occurred locally in many sections.

Closely following this period, showers again set in over the upper Mississippi Valley about the 13th and gradually overspread much of the country to the eastward and southward during the following two or three days.

The next important cyclonic area overspread the Missouri Valley and Middle Plains on the 23d and during the 24th and 25th extended into nearly all portions of the country from the Mississippi River eastward, heavy rains being reported locally from points in the middle Mississippi Valley and Great Lakes region, and moderate showers elsewhere.

During the period from the 26th to 30th rather feeble cyclonic conditions existed over the interior districts from the southern Plains eastward, with attending thundershowers, local heavy rains, and occasional storms of tornadic character, some quite severe, particularly during the 26th and 27th in portions of the States from Mississippi to South Carolina, and again on the 28th at points in Oklahoma and Arkansas. Loss of human life from these storms amounted to more than 50, many more were injured, and much property damage was sustained. The details of these will be found in the table of severe storms.

For the month as a whole pressure was below normal over all districts of the United States and Canada from the Great Plains and upper Lake region eastward. Pressure averages were also below normal in California and adjacent portions of the Southwest.

Pressure averages were higher than normal over the Rocky Mountain and adjacent areas and in the far Northwest.

The wind circulation was materially influenced by the persistent low pressure over eastern districts and by the somewhat permanent high pressure over the eastern slope of the Rocky Mountains, the result being northwesterly to southwesterly winds over much of the interior and northern portions of the country.

High winds were not prevalent over extensive areas on any particular date as a rule, but many severe storms of local character, particularly hailstorms, were reported, and local damage to crops was severe in some cases. Reference to these may also be found in the table of severe storms.

TEMPERATURE

The month as a whole stands out conspicuously among the cold Mays of the past half century or more, from the Rocky Mountains eastward. Indeed, in portions of the central valleys the month was the coldest in the recorded weather history, and in many other sections it closely contested the records of May, 1907 and 1917, both of which were months of unusual cold.

On the other hand the far western part of the country experienced during the same period unusual warmth, and there new bounds were set for high average temperatures, which exceeded any observed in May during the past half century or more.

In the main, the low mean temperatures over the eastern two-thirds of the country were not the result of periods of excessive cold, as only in a few instances were the records of low temperature of previous years broken, but were due to continued moderate coolness brought about by the cyclonic circulation or by the presence of cloudy, rainy weather and the resultant coldness of the earth's surface. In portions of the Lake region and other nearby localities

only a few days had temperatures above normal, and in some cases not more than one day during the month was warmer than normal.

In the far West the general absence of clouds or rain, and the dry and heated condition of the soil greatly favored the accumulation of heat in the atmosphere. Here too the heat was nearly continuous, some stations reporting not more than two days with temperature below the normal.

All the weeks of the month had temperatures below normal over some portions of the central valleys and eastern districts and all had temperatures above normal over the greater part of the far West. The period of greatest contrast was during the last decade when temperatures ranged from 6° to 15° below normal in portions of the Great Plains and adjacent areas, while in the Pacific coast States the averages were nearly as much above the normal.

The principal periods of high temperatures were the 5th to 7th from the northern Plains eastward to the Atlantic coast; about the 17th to 19th over the Southwest and far West; and the 26th to 29th in the Gulf States.

The lowest temperatures were mainly during the first decade over the districts from the Rocky Mountains westward, and from the upper Lakes eastward, and in portions of the Gulf States; near the beginning of the second decade in the west Gulf States; and during the early part of the last decade in portions of the Ohio Valley.

Temperatures reached the freezing point or lower in most localities north of the Ohio River and in the mountain regions to the eastward as far south as the Carolinas. West of the Mississippi temperatures as low as 32° were observed in all States except Louisiana and Texas, although the lower elevations of the Southwest and the Pacific coast districts were generally without frost.

The average temperatures of the month were below normal over all portions of the United States and Canada from the Rocky Mountains eastward, the regions of greatest deficiency embracing the Ohio, middle and upper Mississippi, and lower Missouri Valleys, and most of the Great Plains area.

West of the Rocky Mountains the average temperatures were everywhere above normal, the greatest excesses being reported from the Plateau region, where they ranged from 6° to 9°.

PRECIPITATION

Considering the country as a whole probably two-thirds of the area had deficient precipitation as compared with the usual fall for the month. However, the eastern third had amounts in many cases far in excess of the normal, and in portions of the Middle Atlantic States precipitation was of almost daily occurrence, and the soil remained too wet for cultivation throughout practically the entire month. In the upper portions of the Potomac River watershed the precipitation for the month ranged up to 10 or 12 inches, being particularly heavy about the 10th to 12th and resulting in one of the severest floods in recent years over the middle and lower portions of the river, the details concerning which will be found elsewhere in this issue. Over other sections east of the Mississippi the precipitation was mainly above the normal, though there was a distinct shortage over portions of the Southeastern States, notably Florida, where in the vicinity of Jacksonville it was the driest May in 50 years.

West of the Mississippi River, except in Louisiana and portions of Missouri and Texas, and locally in the middle

Rocky Mountain region, the precipitation was everywhere less than normal and the deficiency was large and detrimental to crop growth over much of the upper Mississippi and lower Missouri Valleys and Middle Plains region, where it was among, and in some cases, the driest ever experienced in May.

Farther west, particularly over the Pacific coast sections, the deficiency in precipitation, which has persisted locally for many months, continued, and in many portions of California, Nevada, Oregon, and Washington and nearby sections of other States it was the driest May of record. At Eureka, Calif., May was the eighth consecutive month with precipitation below normal, and the total deficiency since the first of the year was nearly 20 inches. Similar conditions exist in other portions of California, also in Oregon and Nevada.

Due to deficient snowfall during the past winter over much of this region, and to its early melting on account of the high temperatures, the rivers in many sections are at the lowest stages ever known and steps are already being taken to conserve the diminishing water supplies.

SNOWFALL

Some heavy snows fell during the month in the middle Rocky Mountain States, particularly near the end, the depths ranging up to 50 inches or more at some of the more elevated points. Elsewhere in the Rocky Mountain system there was little or no snowfall, and no meas-

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SEVERE LOCAL HAIL AND WIND STORMS, MAY, 1924

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path (yards) ¹	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Peabody (near), Kans.	2					Heavy hail	Damage not reported	Official, U. S. Weather Bureau.
Fort Bayard, N. Mex.	2	12:10-12:30 p. m.	2 mi.		\$4,000	Damaging hail	Considerable damage to fruits, path 5 miles long.	Do.
Indianapolis, Ind.	3					Thunderstorm with wind and hail	Considerable damage to plants and window panes.	Do.
Seneca County, Ohio. (s. w. part of)	3	p. m.				Tornadoic wind	Heavy property damage	Do.
Cocoaanut Grove, Fla.	4					Heavy hail	Minor damage	Do.
Boone County, Mo.	5			2		Thunderstorm	School boy of Columbia and farmer near Centralia killed by lightning.	Do.
Upland, Nev.	6	5-6 p. m.	1,200.			Hail	About 75 per cent of fruit crop and gardens damaged. Path 10 miles long.	Do.
Idlawild, Tenn.	6			1		Electrical	Farmer and horse killed by lightning.	Do.
Dongola, Ill.	6				3,000	Hail	Crops damaged	Do.
Grant County, Ky. (n. part of)	7	2 p. m.	1,760.			Heavy hail	Early garden truck damaged. Path several miles long.	Do.
St. Marys Ohio, (vicinity of)	7					Wind	Electric light and trolley poles blown down	Do.
Bradshaw, Tex.	8	7 p. m.	3.5 mi.			Hail	Entire loss of seed planted	Do.
Mercedes, Tex.	8	6 p. m.	880.		5,000	Heavy hail	Roofs damaged. Greater part of storm over unproductive land. Path 2 miles long.	Do.
Trzevant (near), Tenn.	8					Wind, rain, and hail	Farm lands washed, fruit trees uprooted, peaches and strawberries injured.	Do.
Marquette County, Mich.	8-9				10,000	Glaze	Damage principally to telegraph and telephone poles and wires.	Do.
Seguin, Tex.	9	1 a. m.	6-7 mi.			Heavy hail	All cotton in 100 square miles destroyed; corn suffered and oats destroyed.	Do.
New Braunfels, Tex.	9	1:50 a. m.	12 mi.			Hail	Window panes broken; fruit entirely destroyed, Stones were the size of walnuts.	Do.
Corpus Christi, Tex.	10	1:10 a. m.			15,000	do.	Damage confined mostly to windows, roofs, and garden truck.	Do.
Mayesville, S. C.	11	7:15 p. m.	33.		5,000	Tornado	Character of damage not reported. Short path.	Do.
Vega, Tex.	11	6 p. m.	4 mi.		10,000	Hail and electrical	Heavy damage; also some stock killed by lightning. Length of path 18 miles.	Do.
Clairemont, Tex.	12	2:30 p. m.	1-5 mi.			Heavy hail	Small crops total loss. Some roofs damaged.	Do.
Hermleigh, Tex.	12	6 p. m.				do.	Total loss of crops. Severe damage to houses, fruit, etc.	Do.
Jayton, Tex.	12	4 p. m.	2 mi.			do.	All buildings in path severely damaged	Do.
Jayton, Tex.	13	7 p. m.	13.5 mi.			do.	do.	Do.
Hermleigh, Tex.	13	10:30 p. m.	3 mi.			do.	Total loss of crops. Buildings, fruit, etc., damaged.	Do.
Ablene, Tex.	13	11 p. m.	2-3 mi.		10,000	do.	Considerable damage. Path 5 miles long.	Do.
Plainview, Tex.	13	During night.	3 mi.		25,000	do.	Crop loss varies from 6 per cent to total. Length of path 4 miles.	Do.
Sylvester, Tex.	13	9 p. m.	8 mi.		100,000	do.	Buildings and crops severely damaged. Path 12 miles long.	Do.
McCauley, Tex.	13	8:10 p. m.	2-5 mi.		50,000	do.	Total loss of crops; houses considerably damaged and poultry injured.	Do.
Beeville, Tex.	14	12 midnt.	4 mi.		5,000	do.	Extensive area of cotton and corn damaged	Do.
Nixon, Tex.	14	9 p. m.				do.	About 5,000 acres of corn and cotton destroyed	Do.

¹ mi. signifies miles, instead of yards.

urable amounts occurred in the mountains of California and Nevada, and that on the ground from previous months had practically disappeared. On some of the more elevated districts where the snow usually lies until July, it had all disappeared early in May. Snowfall was reported from most northern districts at some time during the month and some rather heavy falls occurred from Montana to the upper Lakes near the middle of the first decade.

RELATIVE HUMIDITY

Despite the generally cool weather during the month over the districts east of the Rocky Mountains, and the cloudy, rainy conditions over the more eastern districts, the percentage of relative humidity over the greater part of this territory was less than normal. In the Northeastern States, however, there was a general, though mainly slight excess, and local averages slightly above normal occurred elsewhere, notably on the eastern slopes of the middle and southern Rocky Mountains. Over the Plateau and Pacific coast States there were general and frequently large deficiencies in the percentage of relative humidity, which would be expected in view of the high temperatures and general lack of precipitation.

Much cloudy, rainy weather prevailed over the northern and central portions of the country from the Mississippi Valley eastward, some sections having less than one-third the possible amount of sunshine. Elsewhere sunshine was usually sufficient.